What is claimed is:

1. A solid-state imaging device having an imaging region section provided with a plurality of pixels and a processing circuit section for processing an image signal outputted from the imaging region section, the solid-state imaging device comprising:

the pixel having a photoelectric converting element for generating a signal charge commensurate with a light-receiving amount, a floating diffusion part for detecting an amount of a signal charge generated by the photoelectric converting element, a transfer transistor for transferring a signal charge generated by the photoelectric converting element to the floating diffusion part, and a drain transistor for draining a signal charge generated by the photoelectric converting element;

the photoelectric converting element being formed by a buried photodiode having a charge separating region formed by a first conductivity type high-concentration impurity layer in an extreme surface of a semiconductor substrate and a charge storing region formed by a second conductivity type impurity layer in a layer beneath the charge separating region;

both a channel potential on the drain transistor being turned on and a channel potential on the transfer transistor being turned on being set higher than a potential for depleting the photodiode.

2. A solid-state imaging device according to claim 1, further having a reset transistor for resetting the floating diffusion part with a signal charge, an amplifying transistor for outputting an electric signal corresponding to a potential on the floating diffusion part, and a selecting transistor for selectively activating the amplifying transistor.

3. A solid-state imaging device according to claim 1, wherein the transfer transistor has a gate electrode being applied by a transfer bias voltage to form a first conductivity type channel layer at an interface to a gate insulation film of the transfer transistor in a charge storing time period of the photoelectric converting element, and the drain transistor has a gate electrode being applied by a drain bias voltage to form a first conductivity type channel layer at an interface to a gate insulation film of the drain transistor in a charge storing time period of the photoelectric converting element.

4. A solid-state imaging device according to claim 1, wherein after simultaneously resetting the floating diffusion parts on all the pixels in the imaging region section, signal charges of the photodiodes on all the pixels are simultaneously transferred to the floating diffusion parts, next the signal charges transferred to the floating diffusion parts are read out on a pixel-row basis, to keep the drain transistor on until the reading operation proceeds to a predetermined exposure start row and drain the signal charges of the photodiodes on

all the pixels, and to turn off the drain transistor when proceeded to the predetermined exposure start row and start an exposure on all the pixels.

5. A solid-state imaging device according to claim 4, wherein the photodiode, immediately after transferring the signal charge of the photodiode to the floating diffusion part by the transfer transistor, has remaining charges of 20 or less while the photodiode, immediately after draining the signal charge of the photodiode by the drain transistor, has remaining charges of 20 or less.

6. A solid-state imaging device according to claim 4, wherein the drain transistor being on has a gate voltage level higher than a gate voltage level of the transfer transistor being on.

7. A solid-state imaging device according to claim 4, wherein the drain transistor being on has a gate voltage level higher than a power voltage of a digital circuit mounted on the solid-state imaging device.

8. A solid-state imaging device according to claim 4, wherein the drain transistor is off during an operation to read out the signal charge of the floating diffusion part on a pixel row preceding to the exposure start row.

9. A solid-state imaging device according to claim 2, wherein the transfer transistor, the reset transistor and the amplifying transistor have respective gate wirings provided in

a direction along the pixel row, to be driven on a pixel-row basis and the drain transistor has a gate wiring provaided in a direction along the pixel column, which is short-circuited common between all the pixels at an outside of the imaging region section.

10. A control method for a solid-state imaging device having an imaging region section provided with a plurality of pixels and a processing circuit section for processing an image signal outputted from the imaging region section,

wherein the pixel has a photoelectric converting element for generating a signal charge commensurate with a light-receiving amount, a floating diffusion part for detecting an amount of a signal charge generated by the photoelectric converting element, a transfer transistor for transferring a signal charge generated by the photoelectric converting element to the floating diffusion part, and a drain transistor for draining a signal charge generated by the photoelectric converting element;

the photoelectric converting element being formed by a buried photodiode having a charge separating region formed by a first conductivity type high-concentration impurity layer in an extreme surface of a semiconductor substrate and a charge storing region formed by a second conductivity type impurity layer in a layer beneath the charge separating region;

the control method for a solid-state imaging device

comprising:

setting both a channel potential on the drain transistor being turned on and a channel potential on the transfer transistor being turned on higher than a potential for depleting the photodiode; and

enabling to completely transfer the signal charge of the photodiode through both the transfer transistor and the drain transistor, and starting an exposure operation on the photodiode in a course of reading of the signal charge from the floating diffusion part.

11. A control method for a solid-state imaging device according to claim 10, wherein after simultaneously resetting the floating diffusion parts on all the pixels in the imaging region section, signal charges of the photodiodes on all the pixels are simultaneously transferred to the floating diffusion parts, next the signal charges transferred to the floating diffusion parts are read out on a pixel-row basis, to keep the drain transistor on until the reading operation proceeds to a predetermined exposure start row and drain the signal charges of the photodiodes on all the pixels, and to turn off the drain transistor when proceeded to the predetermined exposure start row and start an exposure on all the pixels.

12. A control method for a solid-state imaging device according to claim 11, wherein the photodiode, immediately after transferring the signal charge of the photodiode to the

floating diffusion part by the transfer transistor, has remaining charges of 20 or less while the photodiode, immediately after draining the signal charge of the photodiode by the drain transistor, has remaining charges of 20 or less.

13. A control method for a solid-state imaging device according to claim 11, wherein the drain transistor being on has a gate voltage level higher than a gate voltage level of the transfer transistor being on.

14. A control method for a solid-state imaging device according to claim 11, wherein the drain transistor being on has a gate voltage level higher than a power voltage of a digital circuit mounted on the solid-state imaging device.

15. A control method for a solid-state imaging device according to claim 11, wherein the drain transistor is off during an operation to read out the signal charge of the floating diffusion part on a pixel preceding to the exposure start row.

16. A camera apparatus for outputting an image taken by a solid-state imaging device, the camera apparatus comprising:

the solid-state imaging device having an imaging region section provided with a plurality of pixels and a processing circuit section for processing an image signal outputted from the imaging region section,

the pixel having a photoelectric converting element for generating a signal charge commensurate with a light-receiving amount, a floating diffusion part for detecting an amount of

a signal charge generated by the photoelectric converting element, a transfer transistor for transferring a signal charge generated by the photoelectric converting element to the floating diffusion part, and a drain transistor for draining a signal charge generated by the photoelectric converting element;

the photoelectric converting element being formed by a buried photodiode having a charge separating region formed by a first conductivity type high-concentration impurity layer in an extreme surface of a semiconductor substrate and a charge storing region formed by a second conductivity type impurity layer in a layer beneath the charge separating region;

both a channel potential on the drain transistor being turned on and a channel potential on the transfer transistor being turned on being set higher than a potential for depleting the photodiode.

17. A camera apparatus according to claim 16, wherein the solid-state imaging device further has a reset transistor for resetting the floating diffusion part with a signal charge, an amplifying transistor for outputting an electric signal corresponding to a potential on the floating diffusion part, and a selecting transistor for selectively activating the amplifying transistor.

18. A camera apparatus according to claim 16, wherein, in the solid-state imaging device, the transfer transistor has

a gate electrode being applied by a transfer bias voltage to form a first conductivity type channel layer at an interface to a gate insulation film of the transfer transistor in a charge storing time period of the photoelectric converting element, and the drain transistor has a gate electrode being applied by a drain bias voltage to form a first conductivity type channel layer at an interface to a gate insulation film of the drain transistor in a charge storing time period of the photoelectric converting element.

19. A camera apparatus according to claim 16, wherein, in the solid-state imaging device, after simultaneously resetting the floating diffusion parts on all the pixels in the imaging region section, signal charges of the photodiodes on all the pixels are simultaneously transferred to the floating diffusion parts, next the signal charges transferred to the floating diffusion parts are read out on a pixel-row basis, to keep the drain transistor on until the reading operation proceeds to a predetermined exposure start row and drain the signal charges of the photodiodes on all the pixels, and to turn off the drain transistor when proceeded to the predetermined exposure start row and start an exposure on all the pixels.

20. A camera apparatus according to claim 19, wherein, in the solid-state imaging device, the photodiode, immediately after transferring the signal charge of the photodiode to the floating diffusion part by the transfer transistor, has

remaining charges of 20 or less while the photodiode, immediately after draining the signal charge of the photodiode by the drain transistor, has remaining charges of 20 or less.

21. A camera apparatus according to claim 19, wherein, in the solid-state imaging device, the drain transistor being on has a gate voltage level higher than a gate voltage level of the transfer transistor being on.

22. A camera apparatus according to claim 19, wherein, in the solid-state imaging device, the drain transistor being on has a gate voltage level higher than a power voltage of a digital circuit mounted on the solid-state imaging device.

23. A camera apparatus according to claim 19, wherein, in the solid-state imaging device, the drain transistor is off during an operation to read out the signal charge of the floating diffusion part on a pixel row preceding to the exposure start row.

24. A camera apparatus according to claim 17, wherein, in the solid-state imaging device, the transfer transistor, the reset transistor and the amplifying transistor have respective gate wirings provided in a direction along the pixel row, to be driven on a pixel-row basis and the drain transistor has a gate wiring provided in a direction along the pixel column, which is short-circuited common between all the pixels at an outside of the imaging region section.

25. A camera apparatus according to claim 16, further

having switch means for switching shutter operation of the solid-state imaging device between a focal-plane shutter operation and an all-the-pixel simultaneous shutter operation.

26. A camera apparatus according to claim 19, further having exposure time selecting means for selecting an exposure time of the solid-state imaging device and exposure start row selecting means for selecting the predetermined exposure start row depending upon an exposure time selected by the exposure time selecting means.

27. A solid-state imaging device comprising:

a plurality of pixels,

the pixel having a light-receiving part, a transfer transistor for reading out a charge generated in the light-receiving part and a drain transistor for draining the charge generated in the light-receiving part,

the light-receiving part having a charge storing region having a potential increasing as the stored charge decreases during reading out charges and during draining charges but lower than a potential on a channel part in a state the transfer transistor is on and a potential on the channel part in a state the drain transistor is on when the charge storing region is substantially depleted.

28. A solid-state imaging device according to claim 27, wherein the charge storing region when substantially depleted includes charges (electrons or charges) in the number of 20 or

less.

29. A solid-state imaging device according to claim 27, wherein the pixel further has a charge holding part for holding a charge read out by the transfer transistor,

the charge stored in the charge storing region being to be read out, simultaneously on all the pixels, to the charge holding part by the transfer transistor included in each of the plurality of pixels,

the charge held at the charge holding part included in each of the plurality of pixels being to be read out as a pixel signal in a predetermined order to an external of the pixel,

the plurality of pixels, in a time period the pixel signal is being read out, being drained of an unwanted charge in the charge storing region by the drain transistors, thereby staring an exposure time period.

30. A solid-state imaging device comprising:

a plurality of pixels,

the pixel having a light-receiving part, a transfer transistor for reading out a charge in a manner substantially depleting a charge storing region included in the light-receiving part, and a drain transistor,

a potential on a channel part in a state the drain transistor is on is higher than a potential on a channel part in a state the transfer transistor is on.

31. A solid-state imaging device according to claim 30,

wherein the charge storing region when substantially depleted includes charges (electrons or charges) in the number of 20 or less.